SECTION 126

CORN BLIGHT REVIEW - SAMPLING MODEL AND GROUND DATA MEASUREMENTS PROGRAM

by

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The study area for the experiment covering portions or all of seven states included over 60 percent of the nation's corn acreage. The sampling plan involved the selection of the study area, determination of the flightline and segment sample design within the study area and determination of a field sample design. Initial interview survey data consisting of crop species acreage and land use was collected by county ASCS personnel. On all corn fields, additional information such as seed type, row direction, population, planting date, etc. were collected. From this information, sample corn fields were selected to be observed through the growing season on a biweekly basis by County Extension personnel.

INTRODUCTION

The sampling model for the Corn Blight Watch Experiment involved the (1) selection of a study area, (2) determination of a segment (test site) sample design and (3) determination of a sample design for selecting fields. In addition, decisions were made on the amount of and type of ground data to collect. The experiment was an unprecedented data collection venture in terms of the type of data required from ground observations.

One of the first decisions made by the Executive Committee was that ground data would be able to stand on its own. Thus, the ground data would serve a dual purpose. First, ground data measurements would provide the basic training sets for photo interpretation and multispectral scanner analysis. Secondly, the ground data measurements would be collected such that meaningful estimates could be made from ground data alone and provide a basis for evaluating remote sensing performance.

The approach used in designing the sampling and ground data models cannot be stressed too highly. It is quite likely that the sampling decisions and the ground data from the Corn Blight Watch

Experiment will not fit any other regional remote sensing venture, but the techniques involved in determining the Corn Blight Watch plan will apply.

A systems analysis approach was used in designing the Corn Blight Watch sampling model and ground data program. Decisions on ground data were never divorced from the impacts that those decisions would have on remotely sensed data. Sampling decisions were not independent of data collection decisions, etc.

Each decision was made by first defining the objectives for that aspect of the program. What was the goal for that aspect? What information or result was desired? How did that aspect function in meeting the overall objectives of the experiment? How would the data collected be used?

Defining objectives seems like a logical and simple step, but many projects (both research and operational) are planned and completed without the objectives being fully defined. Data collected is then often incomplete and improper for analysis. It takes great forethought and perseverance to define objectives clearly at the planning stage.

Once the objectives for an aspect of the model had been defined, the resources available were itemized. In general, the resources used in the experiment were manpower and aircraft.

The constraints on the program and the resources were then considered. Perhaps the greatest constraint in the experiment was time. A large number of people could be made available, but for only a day or so at a time, for example. The desire for monitoring of the blight situation on a biweekly visit placed quite a restriction on data collection.

Once the objectives, resources and constraints had been defined, alternatives were drawn up and decisions made. In defining alternatives, people with expertise in that particular aspect were contacted for advice and opinions. Plant pathologists were contacted about the disease itself. People involved in planning large scale interview and field surveys were contacted about data collection forms and techniques. Aircraft people were contacted since the ground data collection had to be consistent with aircraft data gathering capabilities.

The results of this systems approach was an integrated model for sampling and data collection. For example, initial interview data from farmers provided not only the basis for selection of sample test fields, but provided auxiliary information for remote sensing interpretations.

Because individual farm operators were to be interviewed, approval of the Office of Management and Budget (OMB) was required. The survey plan, interview questionnaire and field observation forms were submitted to OMB and approved. The entire process from first planning sessions to presentation of a complete package to OMB was completed in about six weeks (mid-February to April 1).

SELECTION OF TEST AREA

The first decision in designing the data collection model was the selection of a test area for the experiment. An overall objective of the experiment was to detect development and spread of Southern Corn Leaf Blight (SCLB) over the Corn Belt. However, the Corn Belt is not a rigidly geographic area, but instead is a descriptive term applied to the states which provide considerable acreages of corn for grain. The states in the Corn Belt vary depending on the user of the term.

Thus, the Corn Belt had to be defined. The objectives considered in this determination were to (1) include as much of the nation's corn acreage as possible, and (2) provide as wide east-west and north-south coverage as possible.

The main resources available were assumed to be one RB-57 aircraft and manpower enough to collect data in approximately 200 segments (test sites). An additional resource was considered to be an available sampling center which could select the sample of segments.

The constraints on the size of the test area were (1) number of administrative units (states) involved and (2) desired precision of estimates from collected data. The larger the number of administrative units the greater the amount of time that would be needed for training and length of training time would be critical. Manpower and aircraft resources did not limit the size of the test area in themselves, but they did limit the amount of data which could be collected. Given that only so much data could be collected, precision of estimates would depend upon the size of the area sampled.

Alternatives for selection were defined in terms of corn acres and geographic location. At the time of test area selection, prospective planting estimates by states were available in a release by the Crop Reporting Board of the Statistical Reporting Service, United States Department of Agriculture (USDA). These figures are shown in Table I for the 12 states originally considered as possibilities: Iowa, Illinois, Minnesota, Nebraska, Indiana, South Dakota, Ohio, Missouri, Wisconsin, Michigan, Kansas and Kentucky.

In addition, the most recent estimates of corn acres harvested for grain were plotted by county and by crop reporting district for all states that might be considered in the Experiment. (Crop reporting districts are geographic groupings of counties within states which are used in the Statistical Reporting Service, USDA estimating program. Most of the states in the "Corn Belt" area are divided into nine crop reporting districts).

It was first decided to include counties in the test area only if a whole crop reporting district was included. Also, the minimum number of crop reporting districts in a state which could be included was set at two. These two decisions meant that an additional administrative unit (state) would not be added to the project for the sake of only a few counties with considerable corn acreage.

The test area decided upon includes all of Ohio, Indiana, Illinois and Iowa, the eastern crop reporting districts of Nebraska, the southern crop reporting districts of Minnesota and the northern and eastern crop reporting districts of Missouri. The portions of Nebraska, Minnesota and Missouri included in the test area were expected to account for at least 67 percent of the corn acreage for grain in each state.

This test area was expected to include at least 60 percent of the nation's corn acreage for grain in 1971, based on farmers intentions to plant. Table II gives the current estimates of harvested acreage of corn for grain and production in the test area.

The test area provided an east-west magnitude of nearly 900 miles and north-south magnitude of nearly 400 miles. If SCLB would enter the Corn Belt from the south as was believed in 1970, the eastern Missouri and western Illinois areas should give early indications of blight occurrence. The Nebraska and Minnesota counties should provide indications of western and northern spread of the pathogen.

The test area selected is not a homogeneous area in terms of cropping patterns. Percent of land devoted to corn varies greatly between states and within states. Field sizes tend to be larger in the major producing counties in Iowa, Illinois, Minnesota and Nebraska than in Missouri and Ohio. A large proportion of the corn fields in Ohio and Missouri and in parts of the other states are corn fields

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located very close to wooded woods. Some corn fields will be located very close to or in metropolitan areas. Topography and soil types vary greatly between and within states. Thus, the remote sensing applications of the Experiment would involve interpretation of corn against many different backgrounds.

SEGMENT SIZE DETERMINATION

Given a test area for the project, the next necessary step was determination of segment (test site) size and number of segments which could be monitored. Since SCLB should affect different cytoplasms of corn to greater or lesser extents, it was desirable to have as many different cytoplasms present within a segment as possible. In order to reduce time and travel costs, a segment should be no larger than a one-person assignment.

It was necessary to compromise statistical efficiency in order to provide the fairly large segment. Adjacent farms tend to be very homogeneous in terms of proportion of land planted to corn, varieties planted and cultural practices. Therefore, the most efficient sampling procedure for estimates from ground data alone would be to select a large sample of small segments spread throughout the test area. However, this allocation of samples could not be covered in a high altitude aircraft study without going to complete photo coverage of the test area.

Number of segments and size of segment were determined to a great extent by manpower. ASCS indicated a willingness to devote 1,000-1,500 man days to the project for field operations. It was assumed that this input might be matched by the Extension Service of the various states. If interviewing took about one week and if 7 to 8 one-day visits were to be made for field observations, about 200 segments of land could be studied.

Segment sizes from four square miles up to 12 square miles were considered. The smaller sizes would be a convenient size for interviewing. The larger sizes would provide a good number of corn fields in nearly every segment, but might require more than one week for collection of basic data in corn fields.

A rectangular, one mile by x miles, shape was assumed to be the desired shape. The rectangular shape would result in more within segment variation in cropping than would a square segment of the same area. A segment size of one mile by eight miles was tentatively adopted as the desired segment size. This provided a good compromise of ground data time requirements and expected number of corn fields per segment.

SEGMENT SAMPLING DESIGN

The objectives in selecting the segment sampling design were to (1) represent the total area and (2) maximize the statistical precision from the number of segments.

The greatest benefit from the relatively small number of large segments which were possible would have been to draw a simple random or stratified random sample of segments from the area. Selecting 200 counties based on the square root of expected corn acres would have given a good distribution across the test area. Establishing one segment in each county would have minimized ground travel time and cost.

Such an allocation of segments was plotted but it could not be covered within the time constraints of two weeks. It was necessary, therefore, to select a sampling plan based on the aircraft limitations. In order to provide photographic coverage within a two week period, the maximum number of flightline miles was estimated to be about 4,000 miles if flightlines were 100 miles or longer and about 3,000 miles if individual lines were to be 50 miles or less.

The sampling plan was reevaluated in light of the constraints imposed by the aircraft. The two-stage (flightline and segment within flightline) procedure would limit the statistical precision of estimates from the experiment. All estimates would contain between flightline and between segment within flightline variations. Since segments within flightlines should be relatively homogeneous, the between flightline variance components would be large.

If flightlines were not needed as a stage in the sampling process, expansions of segment totals would be subject to between segment variation only. This between segment component would be larger than the between segment within flightline component, but should have lower total variance than the two-stage procedure.

In order to increase the statistical validity of at least part of the Experiment, it was decided to sample a portion of the test area in the more optimum manner. In order to accomplish this, total photo coverage was requested for a portion of the test area.

The three crop reporting districts in western Indiana were selected as the area for the more optimum sampling scheme. Many of the resources available were concentrated in this area. Since the scanner aircraft could not cover the larger area in a two-week period, all scanner flights would be made in the western Indiana area.

The experienced analysts at the Laboratory for Applications of Remote Sensing (LARS) and Willow Run Laboratories (WRL) felt that 15 segments of data would be a substantial assignment for computer analysis from each overflight. Thus, 30 segments were designated for the intensive study area, with half of the segments to be analyzed at WRL and the other half at LARS.

It was decided to sample the rest of the test area with 30 flightlines of approximately 100 mile lengths, each containing six segments. This gave a total of 210 segments (30 + 180) to be selected. The total flightline length exceeded the preliminary target of 4,000 miles, but there would be some efficiencies since western Indiana would be totally covered.

SELECTION OF SEGMENTS

Segments in both the intensive study area and the remaining portion of the test area were chosen by accounting for all land on maps and selecting the sample of segments from the total. In the intensive study area, this process involved a process of physically assigning all land to a specific segment. All of the segments were delineated on maps and a systematic sample of 30 segments chosen.

In the portion of the test area outside western Indiana, 1:1,000,000 aeronautical charts were divided into flightlines of eight miles wide by approximately 100 miles long. A systematic sample of 30 flightlines was chosen. Each flightline was then divided into segments of size one mile by eight miles. A sample of six segments was chosen in each flightline.

In both selection procedures, nonagricultural land was excluded from the sample before segments were selected. Definite nonagricultural areas were identified and boundaries drawn in around the excluded areas. Small (less than four square miles) areas of nonagricultural land were not excluded and all questionable land was left in the sample.

In order to facilitate the scanner analysis, segments in the intensive study area were orientated north-south. They were drawn with section lines as the center of the one mile wide segments so that roads would be located down the center of the segment as often as possible. The length of these segments was also increased to 10-12 miles in order to guarantee more corn fields for analysis.

The segments outside of western Indiana were mainly one mile north-south by eight miles east-west. Thus, the segments were oriented across the line of flight in order to maximize the physical distance between segments within flightlines.

The procedure of excluding nonagricultural land worked quite well considering the mapping materials that were available. Only one segment did not contain any corn fields and that segment did have other agricultural land. Some selected segments were within the metropolitan areas of cities such as Cleveland and Indianapolis, but they did contain corn fields and other agricultural land.

There were some segments in which a large portion of the segment was not agricultural. These were cases in which it was not possible to determine from maps if agricultural uses might be made of the land.

INITIAL INTERVIEW SURVEY DATA

The objectives of the initial interview survey were to (1) identify crop or land use in each field within segments, (2) collect information on corn fields for sample selection, and (3) collect information which might be helpful in remote sensing interpretations.

Experienced photo interpreters and multispectral data analysts were contacted for suggestions for the initial interview. They were asked which characteristics of corn fields they felt would be important in image responses. Specialists in conducting large scale crop interview surveys were contacted about questionnaire content and format.

In the interview procedure adopted, each farm operator was identified and interviewed. Each of his fields was delineated on aerial photography prints and numbered. Acreage and crop or land use was recorded for every field. Nonagricultural areas within the segment were delineated, but no information from them was processed.

Additional information was collected for each corn field. Specific questions were asked about the field and its susceptibility to SCLB. These included cytoplasm of corn planted, variety of corn, whether corn was planted in the same field the previous year and if blight was apparent in corn fields the previous year. The remaining questions were intended to provide information for interpreting the appearance of each corn field on remote sensing images. These questions included date planted, width of corn row, plant population per acre, direction of corn rows and whether the field would be irrigated.

An example of the initial interview form is shown in Figure 1.

The initial interviews were conducted by personnel in the county offices of the Agricultural Stabilization and Conservation Service, USDA. These personnel were experienced in contacting farm operators and in the use of aerial photography.

All interviewers attended a one-day training school. All aspects of the survey were covered in these intensive training sessions. Four man teams from the participating agencies conducted the training schools.

Over 8,200 interviews were conducted by some 300 ASCS personnel during a 10-day period. Information of land usage and acreage was obtained for over 56,000 fields.

SAMPLE FIELD SELECTION

The goal in selection of fields for visits during the growing season was to represent the different cytoplasms present in each segment. However, the number of fields per segment had to be limited to a number which could be visited in one day.

Eight to ten fields were felt to be a reasonable maximum number of fields for an assignment. Once units were established within a field, the field observer would be returning to the same units each time. Since detailed observations were to be made on only five plants in each of the two units in the field, it should not take long for the observations.

The strata used for sample field selection were (1) normal cytoplasm (resistant to SCLB) only, (2) Texas male sterile (susceptible to SCLB) cytoplasm only, (3) blends of normal and Texas male sterile only, (4) F-2 or openpollinated (non-hybrid) fields and (5) combinations of the other strata planted in a field plus unknown cytoplasms. This fifth stratum covered several types of fields, but (except for some fields of unknown cytoplasm) each field in the stratum had some normal cytoplasm plants and some Texas male sterile plants in the field.

The F-2 and openpollinated fields were combined in one stratum because both types did not usually occur in the same segment and both should cause some reduction in yield potential. There were not many of these fields (only about one percent of the expanded acreage) but this lower yield potential and the different susceptibility to SCLB of the two types seemed a reasonable cause for creating the separate stratum.

If two fields were selected from each stratum present, the maximum sample size for a segment would be ten fields. The maximum in most segments would be eight fields since F-2 and openpollinated fields rarely occurred.

Additional ground data was requested for the intensive area segments. Since even ten fields would be a small number of fields for training the computer, the sampling rate for the Texas male sterile and blend strata was increased to three fields each in these segments. This new maximum of 12 fields per segment could not take into account all of the possible blight situations in a segment, but it was an absolute limit on the workload which could be assigned.

In crop yield studies, sample fields are often selected on a probability proportional to field acreage basis. Thus, every acre in the sampling frame has the same chance of selection. This type of sample selection is referred to as self-weighting.

Most studies of SCLB in 1970 concluded that level of infection was generally fairly uniform within fields. Since the main purpose of the Corn Blight Watch Experiment was to study blight infection, not corn yield, fields were selected on an equal probability basis. That is, each field within a stratum in a segment had the same chance of selection, regardless of size.

Equal probability selection will result in more small fields being selected than would probability proportion to acreage selection. The larger number of small fields was expected to create some problems for scanner analysts in locating fields and training the computer, but it was felt to be the best way to study the effects of SCLB.

Most of the field observations were to be made by personnel of the Extension Services within each state. The State Extension Services work closely with farm operators providing information about various aspects of farming.

It was envisioned that nearly all sample corn fields might be needed for training by photo interpreters and scanner analysts. There would be few, if any, fields with ground data left for testing of classification results. Therefore, an additional sample of fields was selected in 24 segments. These additional fields were worked by ASCS personnel. These additional fields could be used for testing by individual interpreters and analysts, and they would provide insurance that adequate ground data was being collected in at least part of the segments in case more data was needed for training.

The 24 segments were chosen to give geographic coverage cross the test area and within individual states. Five segments were selected in Iowa, Illinois and Indiana, three segments in Ohio and two segments in Minnesota, Nebraska and Missouri. Segments were requested in particular areas of each state. Specific segments were chosen on basis of number of corn fields and availability of ASCS county personnel for the field observations.

The extra fields were selected from only the normal cytoplasm, Texas male sterile cytoplasm and blend field strata. Two fields were selected from each of the above strata, provided two or more fields remained in the strata after the original sample had been selected. The original sample fields were excluded and a systematic sample of two fields was selected from the remaining fields.

Table III summarizes the number of fields selected in individual segments. Numbers in all cases are original number of fields selected.

As indicated in Table III, only one segment did not have any corn fields and just one segment contained a single corn field. Since desired sample size per stratum was two fields, the selection of an odd number of fields such as seven, nine or 11 indicates that only one field was available in some strata.

One criticism of the field selection procedure was that a very high number of small fields were selected. The small fields were particularly a problem in the intensive study area where the multi-spectral scanner analyses were performed. The analysis techniques used involve either preparing a tape loop from each training field or outlining the field boundaries on a visual display. A very small field may be too small to effectively use for training purposes.

It is important for several reasons to not ignore these small fields, however. In some applications of remote sensing the small fields might actually be different than large fields. For example, different cultural practices might be used in large fields. Secondly, to improve remote sensing technology the small field problems must be solved. Some crops for which crop identification might be desired such as tobacco are commonly grown on small acreages. In addition, as scanner systems go to higher altitudes to more efficiently cover larger areas, large fields will then be small in terms of number of data points.

Another reason for not ignoring small fields is that even for corn a considerable portion of the crop might be grown in small fields. The corn field size results from the initial interviews in the intensive study area of western Indiana are presented in Table IV.

The percent of total corn fields column of Table IV indicates the approximate distribution of field sizes expected when sampling with equal probabilities of selection. The percent of total corn acres column indicates the expected sample distribution if probability proportional to corn acres selection had been used. These distributions are only approximations since small or large fields might be concentrated in certain segments.

One alternative to the equal probability or probability proportional to size selection would be to select large and small fields at different sampling rates. However, that procedure would not have been possible in this survey because of the constraints of estimating for 5 strata and keeping sample field allocation to a maximum of 10-12 fields at the same time. Splitting each strata into large and small fields and selecting at least two fields in order to calculate variances would have doubled the sample size.

FIELD OBSERVATION DATA

The Field Observation Form was designed to obtain four types of information to describe the conditions in two randomly selected units within the sample field:

1. The amount of vegetation present.

2. The presence and severity of Southern Corn Leaf Blight and other leaf diseases.

3. The presence and severity of other crop stresses.

4. Crop maturity and other information which might affect photography and scanner imagery.

To obtain estimates of the amount of vegetation present, the following items were measured or counted: row width, number of plants in 30 feet of row, number of leaves per plant on five plants in the unit, and length and width of the leaf at the seventh node of each sample plant. From these items plant population and a leaf-area index could be calculated.

Data for estimating Southern Corn Leaf Blight infection were obtained in two ways: (1) Placing each of the five sample plants in unit 1 and 2 into a blight severity class from zero (none) to five (very severe), and (2) counting the number of lower and upper leaves with lesions and estimating the percentage of lower and upper leaf area covered by lesions. The first rating by the field observer was called a subjective rating. Pictures and descriptions of the different severity classes were included in a disease detection handbook which was prepared. An "objective" blight severity rating using the information in (2) was calculated as an aid to the photo interpreter.

Other stresses such as drought, extreme weediness, lodging, hail damage, insect damage, other diseases and nutrient deficiency were identified. Specific comments describing the kind and extent of stress were requested of the field observers to aid in the interpretation of the sample fields on photographs and scanner imagery.

Other information which might aid remote sensing interpretation included number of plants with tassels, stage of maturity and uniformity of the field. The field observer compared the randomly selected units with the portion of the field surrounding the units in answering whether the units were representative of the field.

Figure 2 is an example of the field observation form designed for the Corn Blight Watch. The same form was used throughout the season except for the questions on width of rows and number of plants.

The basic assumptions underlying the field observation procedure were that data should be repeatable and consistent. If two people were sent to the same field independently, the results should be the same. Also, observations taken throughout the season should be of the same plants. Thus, variation in observation results will be done to physiological changes, not sampling variations.

In order to have repeatable and sequentially consistent data, certain plants or certain areas of the field must be defined and marked. Procedures were designed so that each observer would locate, define and mark units in exactly the same manner.

The desires to have good within field information and at the same time have as many fields as possible were compromised. It was decided to establish two units for observation within each sample field. Two units would allow estimation of within field variations but not greatly increase the time per field over one unit so an observer could visit several fields in one day.

Since it was important to keep definitions and procedures as simple as possible, a unit size of one row, 30 feet long was adopted. This would not give any indication of within unit (between row) variation but it would mean that length measurement would be needed only once in each unit. The fairly long length of 30 feet should ensure a sufficient number of plants for observation in most units.

In order to ensure that each observer would establish units similarly, a random location of units were specified. However, to reduce the workload within a field, the location of the first unit in a field was limited to no more than 200 rows and 200 paces from the starting corner. In addition, the second unit was defined to be 30 rows and 30 paces beyond the first unit. Thus, the two units would be located a distance apart but would not require two completely separate location steps.

Individual plant observations were made on the first five plants of each unit. The total unit was used for determining plant population, other stress factors and representativeness of the units. Plant population was collected on only the first and last field visit in order to reduce within field time requirement.

One suggestion which was expressed was to use the six level (0 to 5) blight severity scale as the only indication of SCLB intensity. This would greatly reduce the within field time requirement. However, this would have supplied very little information on actual intensity of blight. Plants can vary greatly in terms of numbers of blight lesions, amount of leaf area covered by lesions and even location of SCLB on the plants and still be in the same severity class. Severity of infection can change considerably on a plant but it might still be classified as the same severity class.

Recording of some specific measures of blight infection would allow a better comparison of blight condition from one period to another. The measures would not have to be very precise; the important thing would be a good indication of relative blight condition. Recording some specific information on blight infection would also allow analysts to interpret differences in fields which have the same subjective blight rating.

Other individual plant observations were blight lesions on stalks, ears or ear shoots with blight lesions and ears with evidence of ear rot. These items were included to give indications of severity of blight infection.

Most field observations were made on Monday or Tuesday of the designated survey week. If weather prevented observations on the intended date, they were made as soon as possible afterwards. Some observations were delayed longer or missed on a particular mission if the field observer was "rained out" on the regular observation date and could not fit the observations into his schedule soon afterwards.

PREHARVEST YIELD FORM

There was considerable interest as the growing season developed in collecting of yield information from each field. It was hoped that this information give some indications of the effects of SCLB and corn yields during 1971. A Form B-9 was designed to collect yield information for each field.

Yield information was not included as part of the original data collection plan for a number of reasons. First of all, the sampling procedures used were designed to study incidence of blight and were not optimum sampling procedures for making yield estimates. It could not be predicted before the season what the extent of blight would be in 1971 and whether yield information would be of value or not.

Also, if yield information did turn out to be important, procedures for collecting this information could be better prepared during the season when the blight situation could be observed.

Figure 3 is a copy of the B-9 form. Its format follows that of the other field observation forms as much as possible.

The preharvest yield visit was to be made as close to the actual date of harvest as possible. One of the indications of damage on the B-9 form was number of ears of corn already on the ground. For this item to be meaningful, observations had to be made close to harvest.

All harvested ears were mailed to LARS for laboratory analysis. This analysis consisted of inspection for damage, weighing of grain and moisture testing.

Table I.--1971 Prospective acreages of corn for grain, by states 1/

State	Indicated acres	Percent of 35 states 2/	Cumulative percent
	000		
Iowa	11,841	16.89	16.89
Illinois	10,442	14.90	31.79
Minnesota	6,254	8.92	40.71
Nebraska	6,145	8.77	49.48
Indiana	5,418	7.73	57.21
South Dakota	3,628	5.18	62.39
Ohio	3,507	5.00	67.39
Missouri	3,301	4.71	72.10
Wisconsin	2,907	4.15	76.25
Michigan	2,003	2.86	79.11
Kansas	1,672	2.39	81.50
Kentucky	1,167	1.67	83.17
12 State total	58,285	83.17	---
35 State total	70,088	---	---

1/ Prospective plantings, January 25, 1971, Statistical Reporting Service, U.S. Department of Agriculture.
2/ The 35 states accounted for 98.3 percent of 1970 U.S. planted corn acreages.

Table II.--Acreage and production of field corn for grain in the Corn Blight Watch test area, 1971 1/

State	Acreage		Production	
	Harvested acreage	Percent of United States	Bushels harvested	Percent of United States
	000		000,000	
Iowa	11,570	18.1	1,180	21.3
Illinois	10,170	15.9	1,037	18.7
Indiana	5,509	8.6	534	9.6
Ohio	3,526	5.5	314	5.7
Minnesota	3,936 2/	6.2	327 2/	6.0
Nebraska	4,004 2/	6.3	340 2/	6.1
Missouri	2,316 2/	3.6	204 2/	3.7
Total	41,031	64.3	3,936	71.1

1/ Source: Crop Production, January 14, 1972, Statistical Reporting Service, U.S. Department of Agriculture

2/ Acreage in state adjusted by proportion of acreage within the test area in 1970.

Table III.--Number of segments by sample size

Number of fields selected	Number of segments: Seven-state area	Intensive study area	ASCS sample
0	1		
1	1		
2	4		
3	4		
4	7		5
5	4	2	
6	7		19
7	14	1	
8	106		
9	15	7	
10	17	13	
11		4	
12		3	
Total..	180	30	24

Table IV.--Percent of corn fields and percent of acreage by field size: Western Indiana segments

Field size	Percent of total corn fields	Percent of total corn acres
Acres		
0-9	33.4	7.3
10-19	30.1	21.2
20-29	15.8	18.8
30-39	8.7	14.5
40-49	4.9	10.6
50-59	2.3	6.0
60-69	1.5	4.7
70-79	0.7	2.7
80-89	0.9	3.9
90-99	0.6	3.0
100 and larger	1.1	7.2

Form A

16. Have all the fields you operate inside the segment boundaries been accounted for? Yes ☐ No ☐
(If NO, go back to Q - 1 and complete column for each missing field)

ASK question 17, if CORN was reported in Question 4.
17. Will you permit us to set out two small plots in your **CORN** fields and visit them twice a month through mid-September? Yes ☐ No ☐

ITEM 12: CONVERSION TABLE FOR PLANTS PER ACRE CODE

Inches between plants	Width of Corn Row - (inches) - Item 11: 20	25	30	36	40
4	4	4	4	4	4
6	4	4	4	4	4
8	4	4	4	3	2
10	4	3	3	2	1
12	4	3	2	1	1
14	3	2	2	1	1
16	2	1	1	1	1
18	2	1	1	1	1
20	1	1	1	1	1

Code	Plants per acre
1	Less than 16,000
2	16,000 - 19,999
3	20,000 - 23,999
4	24,000 or more

NOTES

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
and
Agricultural Stabilization and Conservation Service

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1971 CORN BLIGHT WATCH EXPERIMENT

Form A - Initial Interview

Form Number	1-4	3010
State (________)	5-6	
Flight Line	7-9	
County (________)		
Segment Number	10-12	
Tract Code (________)	13-15	
Date ________	17-19	
Starting time (Military time)	20-23	

In 1970 Southern Corn Leaf Blight had quite an impact on corn production in the Corn Belt. It also caused concern about the availability of seed corn this spring. Because of a possible outbreak of corn blight this year, a cooperative project called the Corn Blight Watch Experiment was developed to monitor any spread across the Corn Belt and to assess levels of infestation. Information will come from periodic field visits and aerial photography during this growing season. One of the sample areas is outlined on these aerial photos.

I would like to identify your farming operation located within the boundaries on these photos. In addition, I want to record the acreage and crop or land use for each field and ask some questions about any corn fields you have planted or intend to plant this year.

____
Enumerator

Time Interview Ended (Military time) | 24-27 |

Figure 1

"Now I would like to ask question about each field you operate inside the segment boundaries". Field No.	28–29 1	28–29 2	28–29 3	28–29 4	28–29 5	28–29 6	28–29 7	28–29 8	28–29 9	28–29 10	28–29 11	28–29 12
1. Total acres in this field	30–33	30–33	30–33	30–33	30–33	30–33	30–33	30–33	30–33	30–33	30–33	30–33
If part of field is outside segment 2. Acres within segment boundaries..................	34–37	34–37	34–37	34–37	34–37	34–37	34–37	34–37	34–37	34–37	34–37	34–37
3. Crop or land use .... *(specify)* (If **CORN**, specify field, sweet or popcorn) *(If field not yet planted, enter operator's intention.)*	38–40	38–40	38–40	38–40	38–40	38–40	38–40	38–40	38–40	38–40	38–40	38–40
Continue if any type of CORN is or will be planted in this field.												
4. Acres of **CORN** planted or to be planted for all purposes................................	41–44	41–44	41–44	41–44	41–44	41–44	41–44	41–44	41–44	41–44	41–44	41–44
5. Acres of **CORN** intended for grain	45–48	45–48	45–48	45–48	45–48	45–48	45–48	45–48	45–48	45–48	45–48	45–48
6. Date **CORN** planted or intended to be planted....	49–51	49–51	49–51	49–51	49–51	49–51	49–51	49–51	49–51	49–51	49–51	49–51
7. *If field corn* - - Type of field corn planted *Enter Code* 1 - Yellow dent 3 - Flint 2 - White 4 - Other ________ *(specify)*	52	52	52	52	52	52	52	52	52	52	52	52
8. Variety (name and number) of **CORN** planted. (List all varieties if more than one)												
9. **CORN** seed cytoplasm planted. *Enter Code* 1 - N (Normal) 3 - B (Blend of N&T) 2 - T (Texas male sterile) 4 - F-2 hybrid 5 - Not known	53	53	53	53	53	53	53	53	53	53	53	53
a. If **BLEND**, what is the percent of Normal cytoplasm seed in this blend? *Enter DK if percent unknown... (percent)*	54–55	54–55	54–55	54–55	54–55	54–55	54–55	54–55	54–55	54–55	54–55	54–55
10. Type of planting pattern. *Enter Code* 1 - Uniform planting of one variety 2 - Large blocks of separate varieties within the field 3 - Narrow (12 rs or less) strips of two or r varieties 4 - Hybrid seed oduction	56	56	56	56	56	56	56	56	56	56	56	56
11. Width of **CORN** row....................... *(inches)*	57–58	57–58	57–58	57–58	57–58	57–58	57–58	57–58	57–58	57–58	57–58	57–58
stimated plants per acre. *Enter Code* 1 - less than 16,000 3 - 20,000 - 23,999 2 - 16,000-19,999 4 - 24,000 or more *If plants per acre not known, determine number of inches between plants and refer to the conversion table on page 4 for code.*	59	59	59	59	59	59	59	59	59	59	59	59
13. Direction of **CORN** row. *Enter Code* 1 - N-S 3 - NE-SW 5 - Contour 2 - E-W 4 - NW-SE	60	60	60	60	60	60	60	60	60	60	60	60
14. Was **CORN** planted in this field last year? *Enter Code* 1 - Yes 0 - No	61	61	61	61	61	61	61	61	61	61	61	61
a. *If Yes*, was corn blight evident in this field last year? *Enter Code* 1 - Yes 0 - No	62	62	62	62	62	62	62	62	62	62	62	62
15. Acres to be irrigated this year	63–66	63–66	63–66	63–66	63–66	63–66	63–66	63–66	63–66	63–66	63–66	63–66

Complete a separate column for each field located within the segment boundaries on these photo prints.

CONTINUE INTERVIEW ON PAGE 4.

Figure 1 - Continued

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
and
State Cooperative Extension Services

O. M. B. Number 40-S71030
Approval Expires 12-31-71

1971 CORN BLIGHT WATCH EXPERIMENT

FORM B-1: Field Observation
(On or about June 15)

Corner of field entered [ ]
N W - 30
N E - 40
S E - 50
S W - 60

Form Number	3011
State Code	
Flight Line	
Segment Number	
Tract Code (________)	
Field Number	
Flight Date	
Date (________)	
Starting Time (Military)	
Comparable plants	

UNIT LOCATION

	UNIT 1	UNIT 2
Number of rows along edge of field		
Number of paces into field		

Are these the same 5 plants visited last time?

Unit 1 Yes ( ) 1 No ( ) 2

Unit 2 Yes ( ) 1 No ( ) 2

COUNTS WITHIN 30 FOOT UNIT	UNIT 1	UNIT 2
1. Width across 10 corn row spaces . . . *Feet & Inches*		
2. Number of plants in the 30 foot unit		

OBSERVATIONS ON FIRST 5 PLANTS	UNIT 1 *Number*	UNIT 2 *Number*
3. Plants with **tassels visible beyond leaves**		
4. Plants with **blight lesions on stalks**		
5. Plants with **evidence of stalk rot**		
6. Plants with **ears** or **silked ear shoots**		
7. **Ears** or **silked ear shoots**		
8. Ears or ear shoots **with blight lesions**		
9. Ears with evidence of **kernel formation**		
10. Ears with evidence of **ear rot**		

– Over –

COMMENTS:

Figure 2

OBSERVATIONS ON INDIVIDUAL PLANTS

	UNIT 1					UNIT 2					TOTALS	
	Plant Number					Plant Number					Unit 1	Unit 2
	1	2	3	4	5	1	2	3	4	5		
Lower 7 Nodes												
11. Number of leaves												
12. Number of leaves with lesions												
13. Percent of leaf area affected with lesions												
Upper Nodes (Above the first 7 nodes)												
14. Number of leaves												
15. Number of leaves with lesions												
16. Percent of leaf area affected with lesions												
Measurement And Infestation												
17. Height of plant (until tassel stage) ...... *Inches*												
18. Length of leaf at 7th node ...... *Inches*												
19. Midpoint width of leaf at 7th node ...... *Inches*												
20. Degree of blight infestation *(Use Code 0, 1, 2, 3, 4 or 5. See Field Manual for detailed explanations.)* ...... Code												

Enter code for each plant, then enter code totals in the Total cells for Item 20 ONLY.

Complete Item 21 if Item 7, Unit 1 is greater than zero.

	EAR NUMBER					TOTAL
	1	2	3	4	5	
21. Stage of maturity of 5 ears or silked ear shoots before Unit 1, Row 1. ...... Code						

2 – Pre-blister
3 – Blister
4 – Milk
5 – Dough
6 – Dent
7 – Mature

22. Observation of other stress factors present in the 30 foot sample row. *(Specify in detail in Comments.)*

1 – None
2 – Lodging
3 – Drought
4 – Extremely weedy
5 – Insects
6 – Hail
7 – Disease other than SCLB
8 – Nutrient deficiency
9 – Other stresses *(Specify)* ____________

Unit 1 *(Codes)* [ ]

Unit 2 *(Codes)* [ ]

23. Are the two sample units representative of the conditions in the area surrounding the units, considering corn blight, condition of stand, other damage, etc.? ...... Yes – 1 No – 2 *Code* [ ]

If No, explain ____________

24. Copy total of infestation codes, Item 20, for each unit on the Field Kit envelope and CHECK ☐

25. CHECK ☐ if an infected corn leaf sample was sent to the State Laboratory.

Enumerator ____________

Ending Time (Military) [ ]

Figure 2 - Concluded

1971 CORN BLIGHT WATCH EXPERIMENT

FORM B-9: Pre Harvest Yield Determinations

Corner of field entered [ ] NW-30 NE-40 SE-50 SW-60

UNIT LOCATION

	Unit 1	Unit 2
Number of rows along edge of field		
Number of paces into field		

Form Number	3019
State Code	
Flight Line	
Segment Number	
Tract Code(__________)....	
Field Number	
....	
Date(__________).......	
Starting Time(Military)....	
Comparable Plants	

Are these the same 5 plants visited last time?

Unit 1 Yes ( ) 1 No ( ) 2

Unit 2 Yes ( ) 1 No ( ) 2

	Unit 1 Number	Unit 2 Number
COUNTS WITHIN 30 FOOT UNIT		
1. Ears attached to plants		
2. Ears on ground in unit		
OBSERVATIONS ON FIRST 5 PLANTS		
3. Plants with stalk rot		
4. Ears harvested from first 5 plants .... (Harvest all ears with grain)		
5. Ears with ear rot		

6. Place ears in separate bags for each unit and attach completed ID tag. (Check)

Unit 1	Unit 2

7. Cytoplasm type. Enter Code		

1 - Normal
2 - Texas male sterile
3 - Blend
4 - F-2 variety
5 - Not known

Enumerator ______________________ Ending Time (Military) [ ]

Figure 3